

5W
B2 (b) carbon black having values of DBP oil absorption (in ml/100 g)
and of BET specific surface area (in m²/g) that fulfil the following relationship:
 $DBP \leq -0.88 \cdot BET + 185.$

REMARKS

Claims 1-11 are pending in this application. Claim 2 has been amended herein, as described in more detail below.

The Examiner objected to the abstract of the disclosure as originally filed, stating that the abstract is two pages long and contains more than 150 words. Therefore, Applicant requests that the Abstract enclosed herewith replace the Abstract originally filed with the above-identified application.

Claims 2-11 have been rejected under 35 U.S.C. § 112, second paragraph as being indefinite. Specifically, the Examiner referred to the portions of Claims 1 and 2 that refer to the acceptable values for D (the amount of diene chains having a 1,2 bond content, in %) and VA (the amount of vinyl aromatic chains, in %). Using 20% as an exemplary value for VA, the Examiner correctly pointed out that the higher limit for the value of D in Claim 1 would be 83.2. However, Applicant respectfully submits that using 20% as the value for VA results in a lower limit of 25, rather than 35 as stated by the Examiner, for the value of D. Thus, using 20% as the value for VA, an acceptable range for the value of D in Claim 1 as originally filed may be stated as follows:

$$25 \leq D \leq 83.2, \text{ where } VA=20\%.$$

Applicant has now amended Claim 2 as shown herein to ensure that the acceptable range for the value of D in Claim 2 is narrower than the range recited in Claim 1. Specifically, Claim 2 has been amended herein to recite that " $D \leq 116 - 1.64 \cdot VA$ ". Thus, again using 20% as an exemplary value for VA, the acceptable range for the value of D in Claim 2, as amended herein, may be stated as follows:

$$34.4 \leq D \leq 83.2, \text{ where } VA=20\%.$$

Therefore, Applicant respectfully submits that Claim 2, as amended, and Claims 3-11 are patentable under 35 U.S.C. § 112, second paragraph.

Claims 1, 2, 7, and 11 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,280,817 to Liu et al. in view of U.S. Patent No. 6,333,375 B1 to Nakamura et al. and Great Britain Patent No. 2 198 138 A to Russell. Generally, the Examiner stated that it would have been obvious to one of ordinary skill in the art to form the barrier layer disclosed by Liu et al. out of the elastomeric mixture presently claimed, taking into account the disclosures of Nakamura et al. and Russell.

First, Applicant notes that the disclosure of Liu et al. seeks to solve the specific problem of a loss of fatigue resistance and/or cord ply breaking that occurs in the sidewall region of truck tires, such as in tandem truck tires. Specifically, Liu et al. attempt to address the problem of blow-outs of such truck tires upon their subsequent reinflation (See, for example, col. 1, lines 16-29). Thus, Liu et al. describe a contoured zone 27, 28, which may be located either between the carcass ply and the innerliner or which may

directly contact the inner cavity of the tire (See col. 2, line 10). A specific aim of the Liu et al. disclosure is that the distance between the cord ply and the inner cavity is greater in the region of the contoured zone than in the region of the tire belt (See Figure 1). Thus, as shown in column 2, lines 57-68, the disclosure of Liu et al. is not specifically describing the composition of this contoured zone. Rather, the contoured zone of Liu et al. encompasses all of the possible components, including the elastomers and/or reinforcing fillers that are described therein. In the embodiments of Liu et al. where the contoured zone 27, 28 directly contacts the inner cavity, the composition of the contoured zone (which is not an intermediate zone but is an inner layer), in particular the elastomeric matrix and the reinforcing filler, must clearly have nothing to do with the composition of the intermediate reinforcement layer of instant Claim 1. This is evident from the list of elastomers that may be used in this contoured zone, which may include butyl rubber (See column 2, line 64). The use of butyl rubber completely contradicts the specific combination set forth in Claim 1 of the present invention, which discloses a natural rubber or a synthetic polyisoprene combined with a copolymer of a conjugated diene polymer and a vinyl aromatic polymer.

Furthermore, the disclosure of Liu et al. does not contain any teaching regarding the objectives of the present invention. Claim 1 of the present invention discloses an intermediate reinforcement layer, which is used to reinforce the inner layer and the carcass ply. This intermediate reinforcement layer also provides mechanical connection between the carcass ply, which typically comprises natural rubber, and the

inner layer, which typically comprises a halogenated butyl rubber. In addition, the disclosed intermediate reinforcement layer of instant Claim 1 also provides a barrier to the migration of oxygen which has passed through the inner layer (See specification, pages 3, 5).

The Examiner has stated that Liu et al. suggest a variety of elastomers and additives, including natural and styrene butadiene, but fail to describe the use of a mixture of elastomers. It has also been stated that the disclosure of Russell defines the use of a natural rubber/styrene butadiene rubber for the carcass topping rubber to impart high adhesive strength and air impermeability. The Examiner alleges that one of ordinary skill in the art would have readily appreciated the barrier layer of Liu et al. to be formed from the claimed mixture since the benefits of the mixture are also desired in the barrier layer.

However, it is respectfully submitted that it is not obvious to combine natural rubber and styrene butadiene. The elastomers listed by Liu et al. include butyl rubber, which is not useful at all to provide a mechanical connection of the carcass ply, which is typically based on natural rubber, to the inner layer, which is typically based on a halogenated butyl rubber. Furthermore, the list of elastomers contained in the disclosure of Liu et al., which actually refers to all existing elastomers, along with the teaching of Russell would not lead one skilled in the art of rubber compositions for tires to specifically combine natural rubber or synthetic polyisoprene with a styrene butadiene rubber, for example. The disclosure of Russell describes a rubber composition

specifically for the carcass ply of a tire which may or may not comprise an innerliner, and which is designed to reduce the amount of compressed air originating from the interior of the tire. The composition disclosed by Russell does not comprise the intermediate reinforcement layer between the possible innerliner and the carcass ply.

In contrast, the present invention uses styrene butadiene copolymer and natural rubber in a different layer than that disclosed or contemplated by Russell. The present invention also requires specific elastomers designed to reinforce the inner layer and to provide mechanical connection of the carcass ply to the inner layer, based on a halogenated butyl rubber. Russell does not disclose or contemplate the particular reinforcement of the present invention and further states that the innerliner may not even exist. Furthermore, the combination of an intermediate reinforcement layer comprising styrene butadiene rubber and natural rubber to improve the mechanical connection with the inner layer was not obvious when considering Liu et al. in view of Russell. The invention disclosed by Liu et al. was meant to solve the problem of avoiding blow-out of truck tires upon reinflation due to cord ply breaks in the sidewall region. It is respectfully submitted that one skilled in the art would not be incited to combine the carcass ply rubber composition disclosed in Russell, since Russell does not aim to solve the problem of ply-breaks in truck tires and discloses a different tire structure, which is devoid of any contoured zone.

With regard to the recitation in Claim 1 of carbon black, the Examiner stated that the quantitative relationship provided in Claim 1 defines a conventional filler

composition. However, Applicant respectfully submits that the limitations in Claim 1 regarding carbon black, which limit the carbon black to one where the DBP is less than or equal to $190 - (0.88)(\text{BET})$, does not define a conventional filler composition. The aim of this limitation in Claim 1 is to select a determined group of useful carbon blacks and also to reject some carbon blacks that are not useful in the present invention, and not simply to use conventional filler compositions. Specifically, the selected group of useful carbon blacks includes N326, with $\text{BET} = 84 \text{ m}^2/\text{g}$ and $\text{DBP} = 72 \text{ ml}/100 \text{ g}$, and N772, with $\text{BET} = 28 \text{ m}^2/\text{g}$ and $\text{DBP} = 65 \text{ ml}/100 \text{ g}$. (See specification, tests 3, 4, 5, 6 of Example 1 and tests 9 and 10 of Example 2). Carbon blacks that have been rejected by the limitations of instant Claim 1 include N375, with $\text{BET} = 100 \text{ m}^2/\text{g}$ and $\text{DBP} = 114 \text{ ml}/100 \text{ g}$. For example, in Test 8 the composition comprised a N375 carbon black, which was not in accordance with the invention because the filler did not satisfy the limitations of Claim 1. (See specification, test 8). Therefore, it is respectfully submitted that the domain of acceptable carbon blacks is not conventional.

The Examiner has stated Nakamura et al. defines a wide range for both the absorption and surface area that would anticipate the broad quantitative relationship in Claim 1 of the present invention. However, Nakamura et al. concerns a rubber composition showing improvements in heat build-up, tensile strength and abrasion resistance (See column 1). The compositions disclosed in Nakamura et al. are characterized in that they contain a specific alkali metal salt or an alkaline earth metal salt of a fatty acid having from 5 to 25 carbon atoms, such as calcium stearate (See column 2,

lines 1-7). Since the invention disclosed in Nakamura et al. does not concern the filler at all but only the metal salt of a fatty acid, the reinforcing filler may include everything possible. For example, the filler of Nakamura et al. may be carbon black and silica. It should be noted that silica is the best mode that is preferably used in the invention of Nakamura et al. (See col. 12, lines 63-66).

Furthermore, it is stated in Nakamura et al. that "no particular limitation is placed on the type of carbon black," which means that all carbon blacks may be used. (See column 2, line 33). For example, Nakamura et al. recites in column 2, lines 33-40 all the carbon blacks that are useful and includes HAFHS in this list, where HAFHS has the following properties: $BET = 90 \text{ m}^2/\text{g}$; and $DBP = 125 \text{ ml}/100 \text{ g}$. Clearly, the properties of HAFHS do not fall within the limitations of the present invention, where the relationship of $DBP \leq -0.88 \cdot BET + 190$ must be satisfied. In addition, the invention of Nakamura et al. does not concern at all an intermediate reinforcement layer.

The Examiner has stated that a variety of embodiments described in Nakamura et al. would fall within the range defined by the Applicant. However, it is respectfully submitted that relationship (ii) of instant Claim 1, specifically, " $DBP \leq -0.88 \cdot BET + 190$ " represents a non-obvious selection over all possible combinations of DBP and BET. Any selected value will fall within the complete scope of all known values, but not all possible values listed in the ranges of Nakamura et al. correspond to relationship (ii) of Claim 1 of the present invention (See discussion of HAFHS above). Therefore, it

is respectfully submitted the range of absorption and surface areas listed in Nakamura et al. do not "anticipate the broad quantitative relationship established in Claim 1."

Lastly, the Examiner has stated that the four quantitative relationships with respect to the copolymer as disclosed in the claims of the present invention are extremely conventional in tire rubber components, and as such, would have been readily appreciated and expected by one of ordinary skill in the art at the time the invention. It has also been stated that the quantitative relationships are satisfied by several embodiments and that the Applicant has not established any criticality in the formation of the aforementioned quantitative relationships.

However, it is respectfully submitted that the relationships concerning the copolymer in Claim 1 of the present invention are not obvious to one skilled in the art. It should be noted that these relationships are to be taken combined with each other and not separately when determining obviousness. Furthermore, these four relationships do not encompass all the conventional styrene butadiene copolymers. For instance, the SBR copolymer, which is commonly sold by the firm Bayer under the trade name "Buna SL 18-0" (VA=18% and D=8%) does not satisfy relationship (1), since 8% is not $\geq 60 - 1.75 \cdot 18$, and is therefore not useful in the intermediate reinforcement layer of the present invention. A second example is the SBR copolymer sold by Bayer under the trade name "Buna SL 25-0" (VA=25% and D=8%), which does not satisfy relationship (1), since 8% is not $\geq 60 - 1.75 \cdot 25$. A third example is the SBR copolymer sold by Dow under the trade name "SE SLR 42000" (VA=20% and D=10%), which also does not satisfy

relationship (1), since 10% is not $\geq 60 - 1.75 \cdot 20$. Although, one of the isolated relationships (for instance (3) or (4): $D > 10$ and $VA > 10$) may be considered conventional for one skilled in the art, it is the whole combination of relationships (1) to (4), combined with the relationship (ii) regarding carbon black and combined with characteristics (a), (b) and (c) for the tire that should be considered when determining obviousness. Consequently, the four relationships establish a criticality in that together they exclude certain SBR and include others.

Therefore, it is respectfully submitted that the combination of all the characteristics of Claim 1 is patentable over Liu et al. with respect to Nakamura et al. and Russell. Since Claim 1 is patentable over the prior art, it is respectfully submitted that dependent Claims 2 to 11 are also patentable. Thus, Applicant respectfully submits that Claims 1, 2, 7, and 11 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,280,817 to Liu et al. in view of U.S. Patent No. 6,333,375 B1 to Nakamura et al. and Great Britain Patent No. 2 198 138 A to Russell.

Furthermore, Claims 3-5 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu et al. in view of Nakamura et al. and Russell as applied to Claim 1 earlier in the Office Action, and further in view of U.S. Patent No. 6,156,822 to Materne et al. For all of the reasons described in detail above, Applicant respectfully submits that independent Claim 1 and therefore dependent Claims 3-5 are patentable over the disclosures applied thereto. Thus, Applicant respectfully submits that Claims 3-5 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,280,817 to Liu et al. in view

of U.S. Patent No. 6,333,375 B1 to Nakamura et al. and Great Britain Patent No. 2 198 138 A to Russell as applied to Claim 1 earlier in the Office Action, and further in view of U.S. Patent No. 6,156,822 to Materne et al.

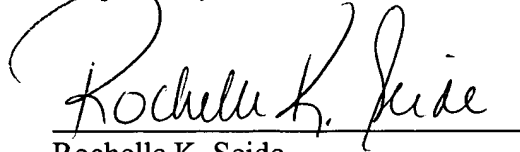
In addition, Claims 6-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Liu et al. in view of Nakamura et al. and Russell as applied to Claim 1 earlier in the Office Action and further in view of U.S. Patent No. 3,639,308 to Topcik. For all of the reasons described in detail above, Applicant respectfully submits that independent Claim 1 and therefore dependent Claims 6-10 are patentable over the disclosures applied thereto. Thus, Applicant respectfully submits that Claims 6-10 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,280,817 to Liu et al. in view of U.S. Patent No. 6,333,375 B1 to Nakamura et al. and Great Britain Patent No. 2 198 138 A to Russell as applied to Claim 1 earlier in the Office Action and further in view of U.S. Patent No. 3,639,308 to Topcik.

In view of the foregoing amendments and remarks, Applicant respectfully submits that Claims 1-11, all the pending claims, are now in condition for allowance.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with markings to show changes made.**"

Applicant respectfully requests that a timely Notice of Allowance be
issued in this case.

Respectfully submitted,

A handwritten signature in cursive script, reading "Rochelle K. Seide", is written over a horizontal line.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Abstract:

Please delete the Abstract as originally filed and replace it with the Abstract enclosed herewith.

In the Claims:

Claim 2 has been amended as follows:

2. (Amended) The tire according to Claim 1, wherein the elastomer comprises
- (a) polyisoprene having a greater than 80% cis-1,4 bond content and a copolymer prepared in solution from conjugated diene and vinyl aromatic monomers, wherein the conjugated diene monomers are selected from the group consisting of butadiene, isoprene and mixtures thereof and the vinyl aromatic monomers are selected from the group consisting of styrene, α -methylstyrene and mixtures thereof, said copolymer satisfying the following relationships:

- (i) $D \geq 66 - 1.58 \cdot VA$
- (ii) $D \leq [124 - 1.71 \cdot VA] \text{ } \underline{116 - 1.64 \cdot VA}$
- (iii) $D > 10$
- (iv) $VA > 10$,

wherein D is the amount of diene chains having a 1, 2 content (in %) and VA is the amount of vinyl aromatic chains (in %), and

(b) carbon black having values of DBP oil absorption (in ml/100 g)
and of BET specific surface area (in m²/g) that fulfil the following relationship:

$$\text{DBP} \leq -0.88 \cdot \text{BET} + 185.$$